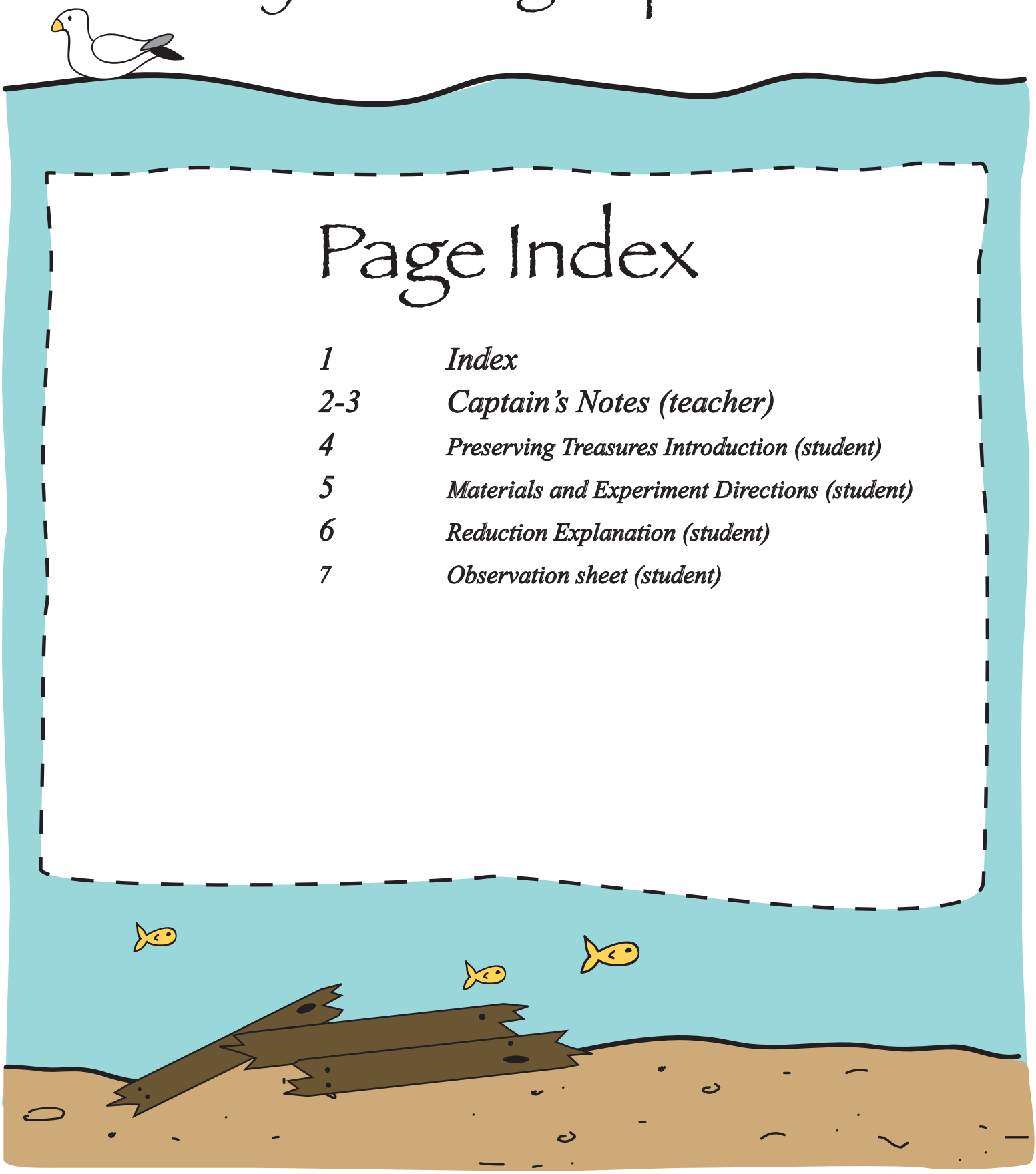
Preserving Treasures:
Penny Cleaning Experiment



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Preserving Treasures : The Penny Cleaning Experiment

Captain's Notes

Overview

In this experiment, students will restore a penny to its former state by a preservation process known as reduction.

Difficulty/Grade Level

Easy-Moderate/K-9

Suggested Group Size

Students work individually. Experiment can be completed in larger groups.

Time

1 Hour and 15 minutes. This includes an hour for the reaction to take place.

Objectives

Students will learn the process and technique at work in reduction, a method that marine archeologists use to restore underwater artifacts.

Skills and Strategies

- *Following scientific procedures*
- *Scientific observation during experiment*
- *Interpreting experiment results: understanding success, or exploring what didn't work.*

Materials

- *1 corroded penny (MUST BE MADE BEFORE 1981) per student.*
- *1 cup of water per student*
- *1/2 cup of baking soda per student*
- *1 piece of aluminum foil (4x4 inches) per student*
- *1 glass or plastic cup per student*
- *1 spoon*
- *Three or four 1/2 cup measuring cups per class*
- *1-cup meausring cup per class*

Preparation

1. *Cut aluminum foil into 4x4 inch sheets.*
2. *Fill each cup or glass with 1 cup of water.*
3. *Set up experiment stations: line up the cups or glasses, and place a piece of aluminum foil beside each.*
4. *Open boxes of baking soda, setting apart from experiment stations.*
5. *Set 1/2 cup measuring cups beside baking soda.*

Procedures

1. *Have students individually read reduction explanation (for younger groups, have a staff member from muesum lead a discussion).*
2. *Have students retrieve cup of water.*
3. *Allow each student to measure and pour baking soda into their cup, and return to station.*
4. *At station, direct students to mix baking soda with spoon. Have them wrap their penny LOOSELY in aluminum foil, and drop into cup.*

5. *Leave for 1 hour. During this time, consider taking a tour of the museum, or begin a second activity. At 1 hour mark, take out aluminum foil and unwrap the penny.*
6. *Examine and record differences.*

Discussion

- ***What happened to the penny while we were away? Why does it look new?***

  Because copper and aluminum are naturally electrically reactive, the corrosion from the penny has moved onto the piece of aluminum. Our electrolyte (the baking soda) has provided them with a means to do so.

- ***What is an electrolyte? What are some basic electrolytes?***

  An electrolyte is a chemical which dissolves in water and allows it to conduct an electric current.

- ***How might the reduction process differ if scientists were working with a corroded artifact much larger than a penny?***

  A larger artifact would take much longer, and need an ouside electric current, like a battery. this would be called electrolytic reduction.

Reeling It In

Review the process of reduction and its uses. ***Our best chance of preserving artifacts is leaving them underwater. It's not only a good idea, it's the law.***

Further Information

- *Visit thunderbay.noaa.gov and the Alpena County Library for information about the shipwrecks of Thunder Bay and further education.*
- *More information on iron conservation can be found at: http://nautarch.tamu.edu/class/anth605/File10a.htm.*

Resources

- *Preserving an American Icon: USS Monitor Center's Penny Cleaning Experiment. http://www.monitorcenter.org/preserving/homeexperiments/homeexperiments2.php. 2009.*

Shipwreck Challenge

Archeaologists use reduction on both freshwater and saltwater artifacts. Before beginning this process, if you were to compare two similar artifacts from each type of water, how would they differ? (See question below for a hint).

Figure It Out

Do saltwater and freshwater artifacts corrode at the same rate?

Freshwater artifacts are far less corroded than saltwater artifacts, because saltwater is an excellent electrolyte. An electrolyte (any substance containing free ions which behaves as an electrically conductive medium) will eventually corrode most metals down to nothing. An absence of salt in freshwater allows for the spectacular underwater preservation of artifacts we have here in Lake Huron.

Preserving Treasures

*Archaeologists seek to understand past cultures by scientifically analyzing the material remains, such as sites and **artifacts** left behind by human activities. Underwater archaeology is the study of any material remains that are found underwater. One particular aspect of underwater archaeology is maritime archaeology. **Maritime archaeologists** study the history of human interaction with seas, lakes, and rivers through the investigation of the remains of vessels, shore side facilities, cargoes, and artifacts.*

Thunder Bay National Marine Sanctuary is an important location for maritime archaeologists. Approximately 200 shipwrecks have been found in and around the sanctuary, representing every type of vessel that sailed on the Great Lakes during the "Shipwreck Century" from 1825-1925.

*Thunder Bay National Marine Sanctuary is located in the cold, fresh waters of Lake Huron. The lake acts like a giant refrigerator for artifacts, preserving them in excellent condition for over one hundred years. Once artifacts are removed from an underwater site and brought up to the surface, they begin to decay or rust quickly. These artifacts need to be conserved and the **conservation** process can take a very long time. Leaving artifacts in place not only ensures the preservation of the artifacts, but also the **preservation** of Great Lakes maritime heritage.*

For maritime archaeologists, the artifacts found on board a ship, as well as the wreck itself, provide clues necessary for understanding the story of a vessel. These clues are like the pieces of a jigsaw puzzle, archaeologists can piece them together to re-create a fuller picture of the ship's story. Artifacts can tell us how a ship was used, where it was headed, and what the daily lives of the crew or passengers on board may have been like. Just like a jigsaw puzzle, each missing artifact leaves a hole in the story. Every item removed from a shipwreck is one more missing detail that may never be recovered.

*The shipwrecks of Thunder Bay and the artifacts on board are valuable cultural resources that provide archaeologists and historians with important information about the past on the Great Lakes. However, gathering this information accurately depends upon archaeologists' and historians' abilities to study these sites before they are disturbed and salvaged. The underwater sites in Thunder Bay represent our shared maritime heritage, making preserving and protecting these sites everyone's responsibility, from **SCUBA** divers to students like you. When visiting these sites, it is important to remember to take only pictures and leave only bubbles.*

Arti-FACTS

*Although archaeologists never remove artifacts from the water, they do receive donated artifacts from citizens and other organizations. When artifacts are turned over to the Great Lakes Maritime Heritage Center, maritime archaeologists take special care is to prevent further decay. A process known as **reduction** is carried out in the Center's conservation lab.*

Activity

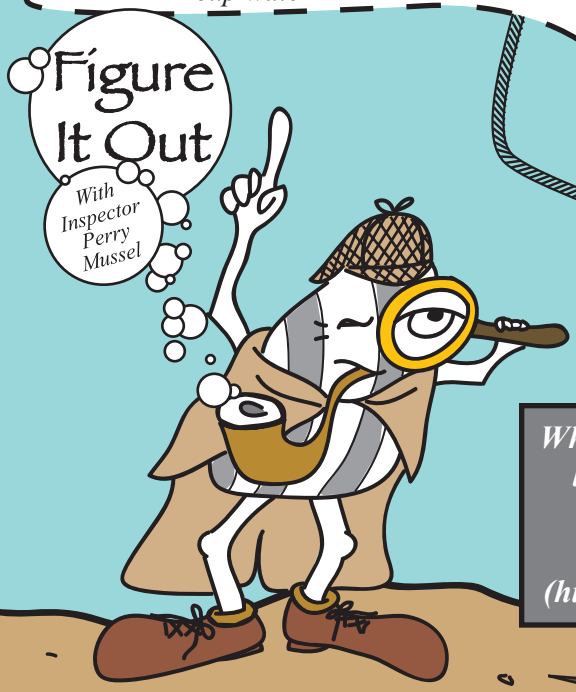
Today, you will act as real maritime archaeologist in an effort to prevent further decay of a shipwreck artifact. In this case, your artifact is a corroded penny. Using the process of reduction, you will reverse the decaying of the copper penny. At the end of the experiment, your penny should shine like new.

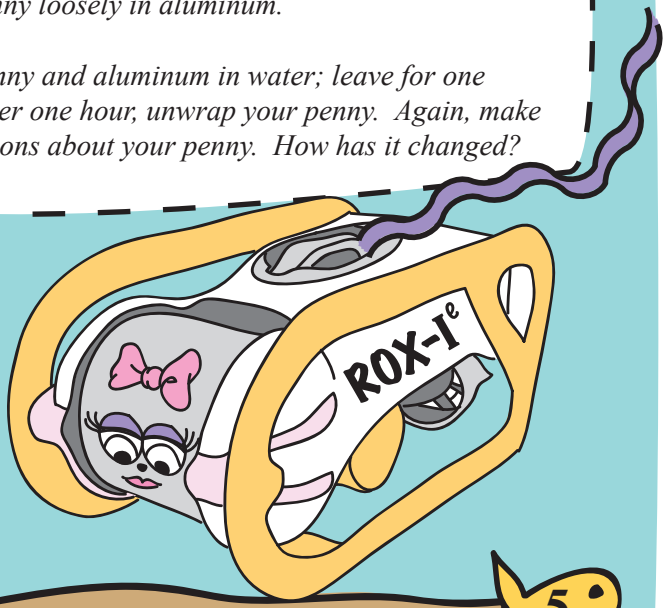
Materials

- *1 corroded penny*
- *1 cup water*
- *1/2 cup of baking soda*
- *1 piece of aluminum foil (4x4 inches)*
- *1 glass or plastic cup*
- *1 spoon*

Crew Commands

1. *Read the Redution explanation on pg. 6. Make some preliminary observations on the observation sheet about your penny. What does it look like?*
2. *Mix baking soda with water.*
3. *Wrap penny loosely in aluminum.*
4. *Place penny and aluminum in water; leave for one hour. After one hour, unwrap your penny. Again, make observations about your penny. How has it changed?*





When did shipwreck looting become illegal in Michigan? (hint: look online!)

Check It Out

Come by the Great Lakes Maritime Heritage Center to see our marine archaeologists in action inside our Conservation Lab.

Reduction Process:

The Penny Cleaning Experiment

Captain's Notes

Reduction: An Explanation

Lake Huron's cold freshwater environment is exceptional for the natural preservation of shipwreck artifacts. Once removed from Lake Huron, however, they immediately begin to decay. Marine archaeologists often use a scientific process called ***reduction*** *when faced with a corroded artifact made of metal. In this process, artifacts are restored to a more stable state, which prevents further decay.*

Essentially, reduction causes corrosion on an artifact to be transferred to another piece of metal. Archaeologists sometimes use electricity (a battery, for example) to start the reduction process. But in this case, we'll see the reaction take place without an added electric current. By loosely wrapping your penny in aluminum, you are providing the two metals needed to begin reduction.

Since these two metals are naturally electrically reactive when put together, we don't need to add an electric current. However, the penny and aluminum do need a medium to conduct the electrical charge between them. An ***electrolyte*** *is a chemical that dissolves when added to water, and causes it to conduct an electric current. In this case, the baking soda is our electrolyte. Mixing it with our water allows this electrical reaction to easily take place.*

You Can Help!

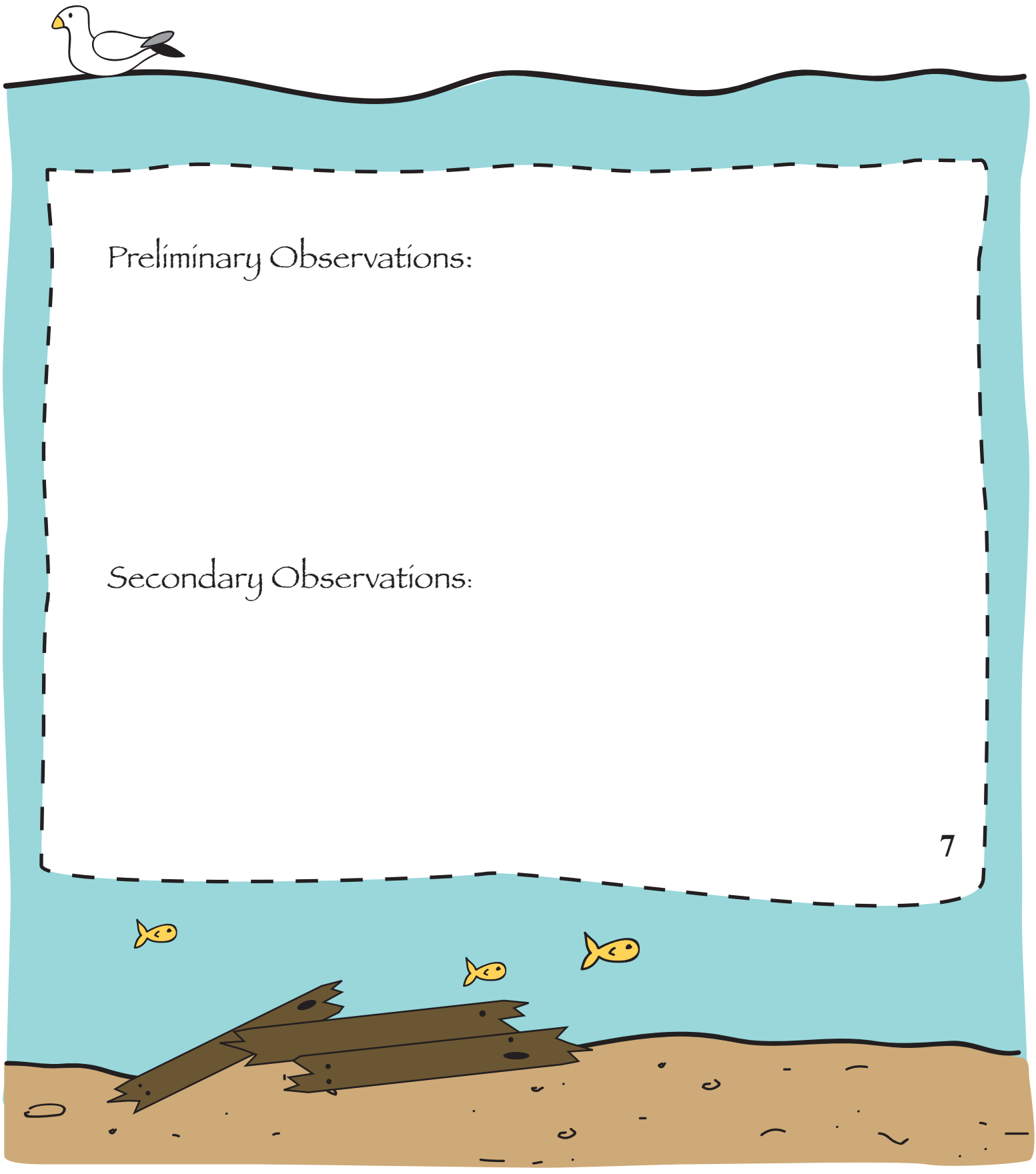
*Our marine archaeologists do all they can to preserve artifacts, but the best environment for them is Lake Huron. Don't loot****: Leave the artifacts in the water where they belong.***

Vessel Vocab

Reduction: a chemical process in which metals are restored to a more stable state, which prevents further decay.

Electrolyte: a chemical that dissolves when added to water, and causes it to conduct an electric current.

Penny Cleaning Experiment Observation Sheet



Preliminary Observations:

Secondary Observations: